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Arrhythmia and Exercise:
A pragmatic, inclusive and safe approach

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Arrhythmias

• Sudden Cardiac Arrest (SCA) occurs at a maximum rate of 90,000 per year in the UK

• 80% of arrhythmias are due to ventricular tachyarrhythmia and HEART FAILURE is strongly associated with arrhythmia (Bryant et al 2005, HTA Review)

• There is a need to consider exercise risk for patients with arrhythmia & those fitted with an ICD

• Are patients with arrhythmias any less fit than other cardiac patients?
Can clinical history help us predict fitness?
Relative fitness of 7,000 cardiac patients

- Chronic AF
- Acute AF
- post PCI
- dyspnoea
- post MI
- chest pain
- arrhythmia
- angina
- DVLA

Mean METS and 95% CI
Relative fitness of 7,000 cardiac patients

Mean METS and 95% CI

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Relative fitness of 7,000 cardiac patients

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Mean METS and 95% CI
Is exercise safe?

It depends who does it!!
Arrhythmia and exercise:

When is an arrhythmia most likely?

Scenario:
23 year old female
Normal stress test during the exercise period
Patient achieves 13.4 METS

What happens next?
Normal stress test during the exercise period and achieved 13.4 METS
What happens to our 23 year old after immediate cessation of exercise whilst standing still on the treadmill?:

As expected heart rate reduces.

End of exercise
62 seconds into recovery arrhythmia starts and patient collapses
Compared to exercise testing:
Is cardiac rehab exercise safe?

• One nonfatal cardiac complication per 35,000 patient hours of exercise participation (Haskell 1978)
• One fatal event for every 116,000 patient hours of exercise participation (ACSM 2005)

• How does it compare to cardiology exercise testing:
  – Four non-fatal complications per 10,000
    • (Fletcher et al 2001)

• Why such a difference?
RPP = \text{peak HR} \times \text{peak SysBP} \times 0.01

75\% \text{ CR training target}
Strenuous activity and risk of heart attack

![Graph showing relative risk of MI onset vs habitual frequency of vigorous exertion. The x-axis represents the frequency of vigorous exertion (0, 1-2, 3-4, 5+), and the y-axis represents the relative risk of MI onset. The graph indicates a trend where the relative risk increases with more frequent vigorous exertion.]
Greatest risk: exercise or sedentary periods

Arrhythmia and normal sleep:
Arrhythmias consisting of sinus bradycardia, sinus arrest and second degree heart block are not uncommon among young adults Corrado et al (2001) whilst sleeping.


High incidence of sudden death among young male Southeast Asians during sleep. The pattern of death has long been prevalent in Southeast Asia and is associated with Right bundle-branch block Nademanee et al., (1997)
Arrhythmia and Sedentary behaviour:

- People with cardiac disease are 7 times more likely to die suddenly during sedentary activities than during jogging.

- The rate heart attacks is highest in sedentary people who decide to do unaccustomed vigorous exercise.

- Holter monitoring of daily activity, confirms that most arrhythmia occurs at rest.

- Although some cardiomyopathy patients may demonstrate exercise induced arrhythmias most share a propensity to die from non-exercise-related cardiac arrest.

- Among 112 patients with sustained ventricular tachycardia, only 15 (14%) were found to have exercise-induced symptomatic ventricular tachycardia.

Where should these be placed: In the gym or by your bed!
ICD patients have taught us plenty about exercise and arrhythmia
Recent ICD Technologies: Integrated Atrial Therapies

**Atrium**
- Atrial tachyarrhythmia prevention
- Antitachycardia pacing
- Cardioversion

**Ventricle**
- VT prevention
- Antitachycardia pacing
- Cardioversion
- Defibrillation

**Atrium & Ventricle**
- Bradycardia sensing
- Bradycardia pacing
Anti-Tachycardia Pacing: well timed little shocks often not noticed by patients.

ICD senses
- HR = 180 at rest
- HR = 70 after ATP

Click image to view animation
ICD scrutiny during exercise

1. ICD threshold e.g. 190 bpm
2. Comparison of:
   - ECG intervals
   - Atria vs ventricle rate
   - VT or VF rate
3. Onset
4. Stability over time
Factors that influence the likelihood of arrhythmia during exercise

<table>
<thead>
<tr>
<th>Increased sympathetic tone</th>
<th>Circulating catecholamines</th>
<th>Psychological state</th>
<th>Cardiac condition</th>
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- **Arrhythmia**

- Reduced parasympathetic tone (start of exercise)
Exercise considerations (cont)

• Mode of exercise
  – most exercises should be performed in standing,
  – Seated exercise, especially using arm work, is associated with reduced pre load and decreased EDV
  – This leads to a concomitant decrease in cardiac output compared to the cardiac response to an equivalent exercise in standing
  – An increase in heart rate is often used to compensate for reduced pre load
  – If seated arm exercise is the only option then the intensity of the exercise should be lowered and the emphasis placed on muscular endurance.

• Breath holding and sustained isometric muscle work, especially of the trunk, needs to be kept to a minimum in patients with low FC and arrhythmia risk
Exercise considerations (cont)

- A note of caution is required for those few patients who are at risk of ICD lead problems

- This situation is often known immediately post operatively and your ICD implant team will have informed you about it.

- In these circumstances it is important to avoid excessive shoulder range of movement and or highly repetitive vigorous shoulder movements

- Light to moderate strength activities performed within a normal range of movement, that closely match functional daily activities have been used successfully in patients with an ICD.
Cardiac rehab patient characteristics

- Demographics based on the literature
  - mean age of 48 (SD 18) range 25-74 yrs
  - IHD, DCM, valvular heart disease, ARVC and Brugada syndrome other long QT conditions.
  - Mean LVEF of 36% (SD 15) (40% of patients < 30% LVEF)
  - Mean implantation period 10 (SD 8) months range 3-24
  - Mean BMI of 26 (SD 6)
  - 1/3 more men than women
Mean ET time +/- 2 standard errors

Exercise test time (seconds)

*-p=0.001-*

*-p=0.002-*

10 minutes

pre base baseline rehab maintenance

*? Reliability*

*p=0.002*
FC & RPP relationship (N=13)

Fitchet, Doherty, Bundy, Bell, Garratt, Fitzpatrick (2003) Heart

RPP (HR x systBP x 0.01)

Rsq = 0.1510

Rsq = 0.3080

Rsq = 0.3700
Mean HAD scores +/- 2 SE

Anxiety

Depression

Clinical level

*---p=0.001---* *---p=0.001---*

Anxiety

Depression

Clinical level

*---p=0.001---* *---p=0.001---*
The context for arrhythmia risk during exercise:

1. Least physically active people
2. Highly emotive activities
3. Intense start to exercise
4. Unaccustomed to the mode of physical activity
5. High relative exercise intensity
6. Sudden cessation of exercise

Key message:

- Regular skilled exercise incorporating warm up with a self monitored moderate intensity of exercise followed by a graded cool down is the proven way to reduce the risk of exercise related arrhythmias.
Thank you for listening

Questions welcome

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Bibliography


Bibliography


